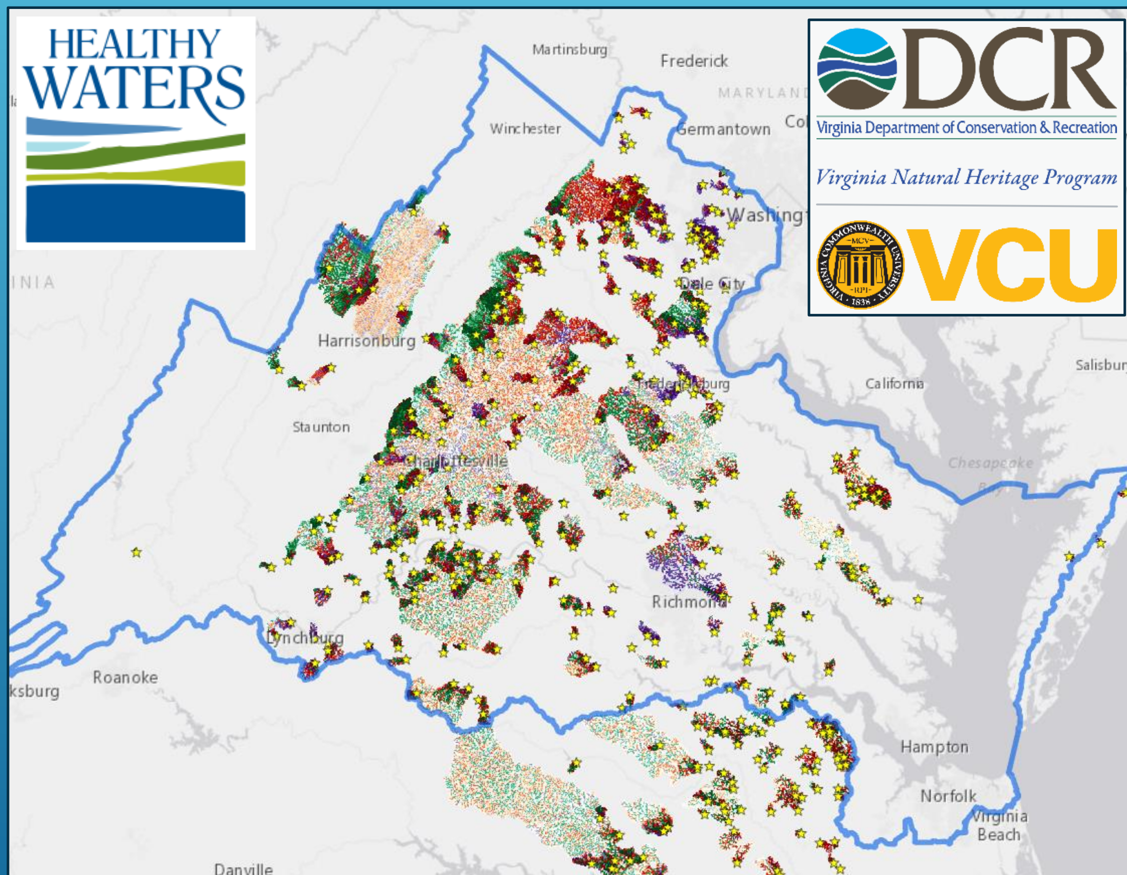
A prioritization model for maintaining Healthy Waters in Virginia

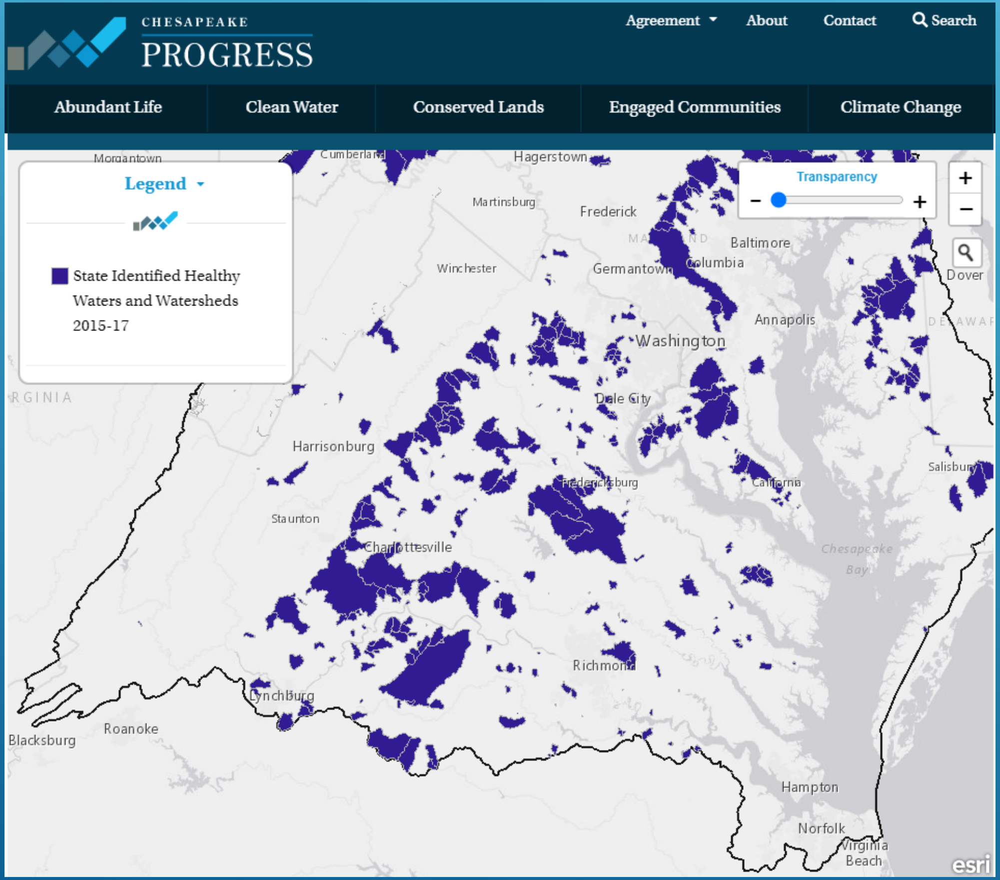


Modelers: Kirsten Hazler and David Bucklin

Goals

CBP desired outcome:

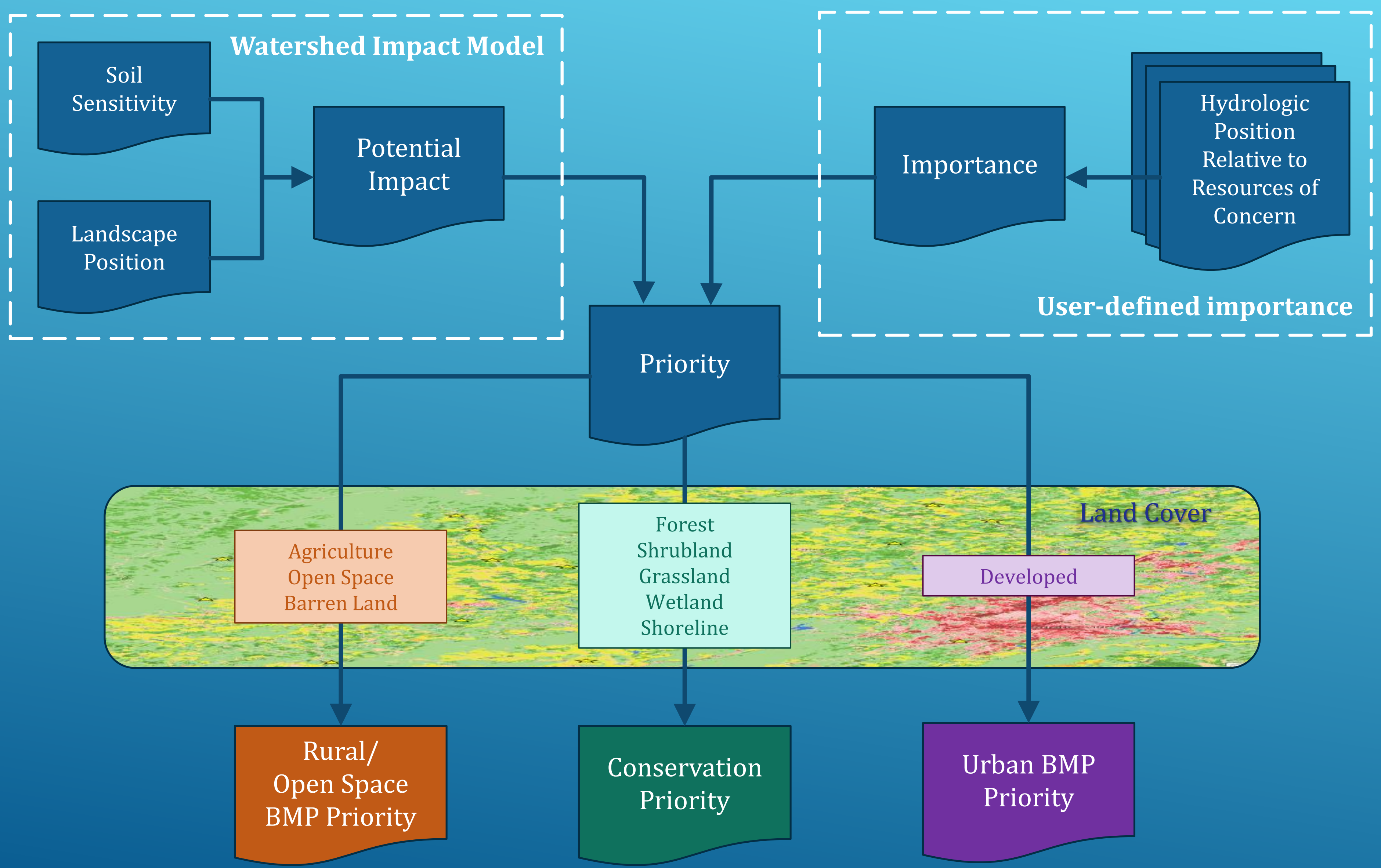
100% of state-identified currently healthy waters and watersheds remain healthy



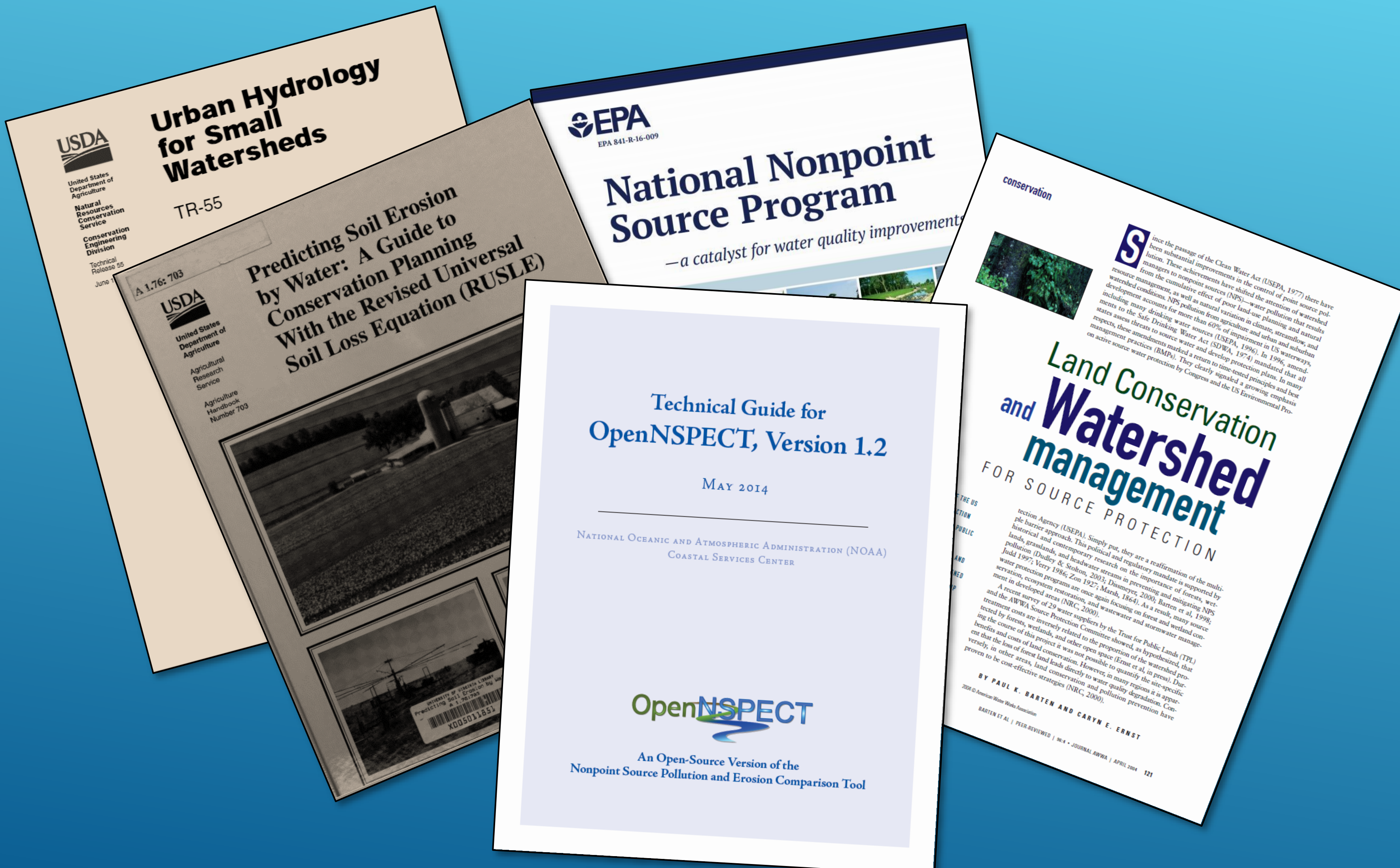
Prioritization model goals:

- Identify lands **most important** for protecting Virginia's Healthy Waters
- Identify lands where activities are likely to have the **greatest impact** on aquatic resources
- Target lands for conservation and BMPs at landscape scales

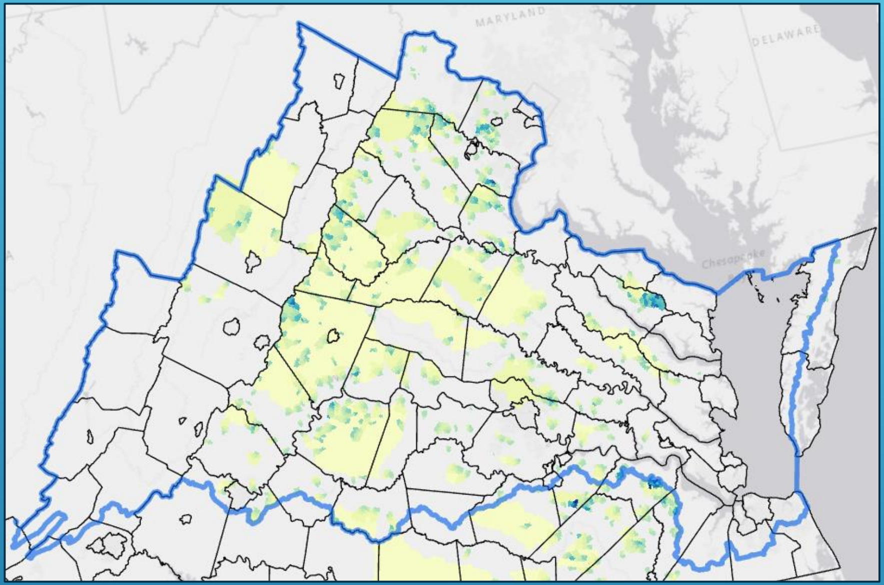
Prioritization using the ConservationVision Watershed Impact Model (2021 version, draft)

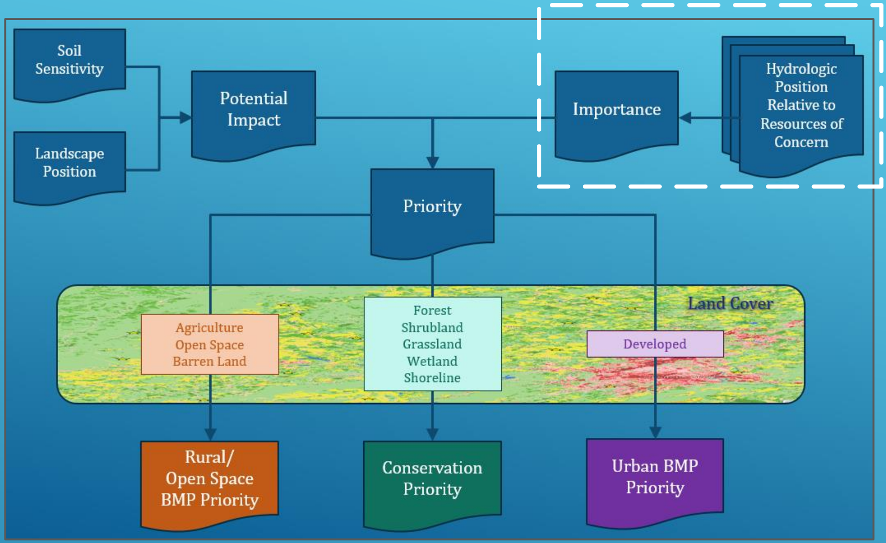


ConservationVision Watershed Impact Model and Prioritization Guiding Documents



Relative Importance



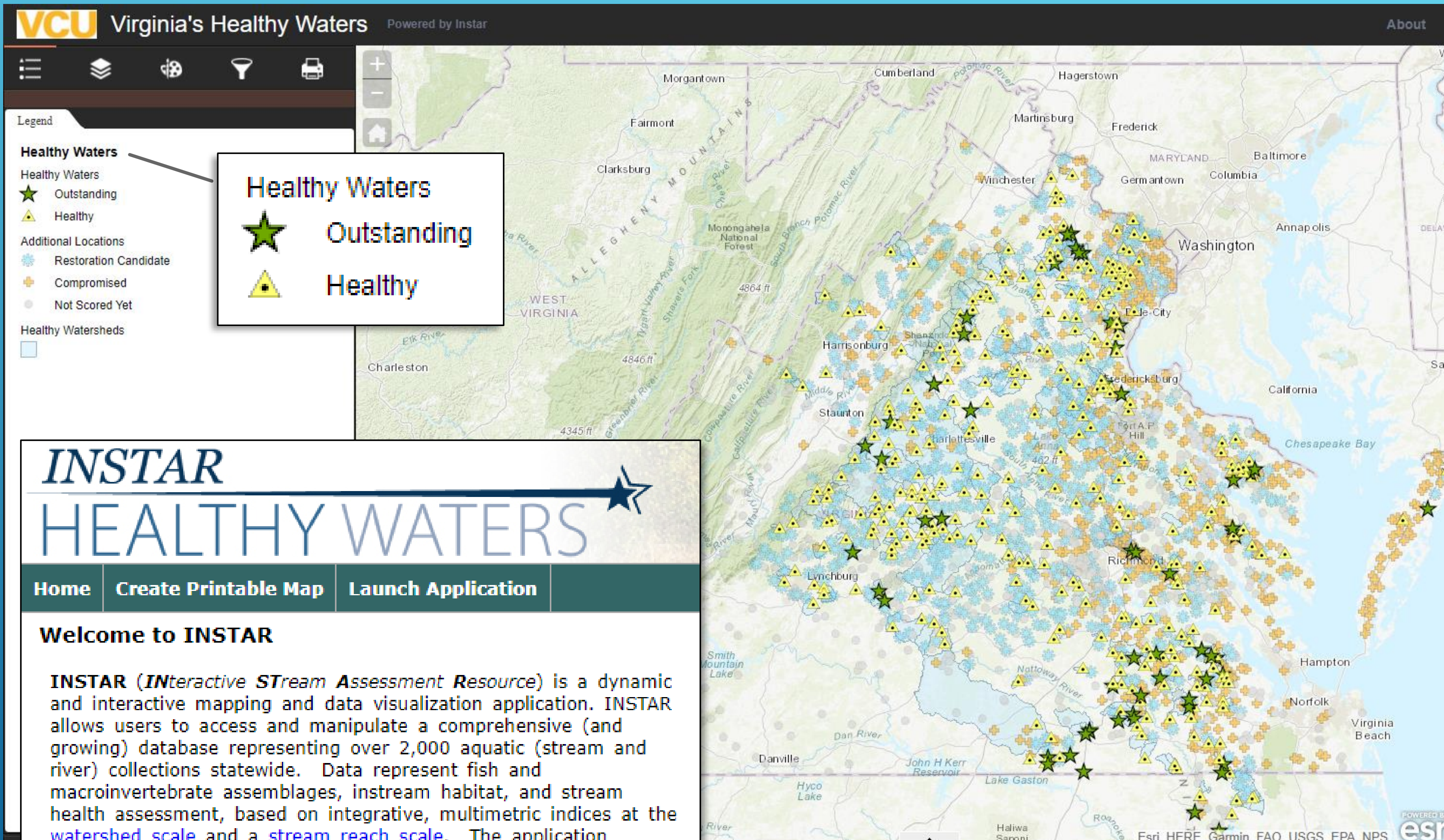


“Importance” is driven by human values, and depends on the specific aquatic resources of concern. In this prioritization, importance is based on hydrologic position relative to known Healthy Waters sites.

Note:

“Importance” is limited by sampling effort; only documented healthy sites contribute to score.

Identifying Resources of Concern



INSTAR
HEALTHY WATERS

Home | Create Printable Map | Launch Application

Welcome to INSTAR

INSTAR (***IN****teractive* ***ST****ream* ***A****ssessment* ***R****esource*) is a dynamic and interactive mapping and data visualization application. INSTAR allows users to access and manipulate a comprehensive (and growing) database representing over 2,000 aquatic (stream and river) collections statewide. Data represent fish and macroinvertebrate assemblages, instream habitat, and stream health assessment, based on integrative, multimetric indices at the watershed scale and a stream reach scale. The application supports user-driven database queries, mapping functions, and online editing capabilities.

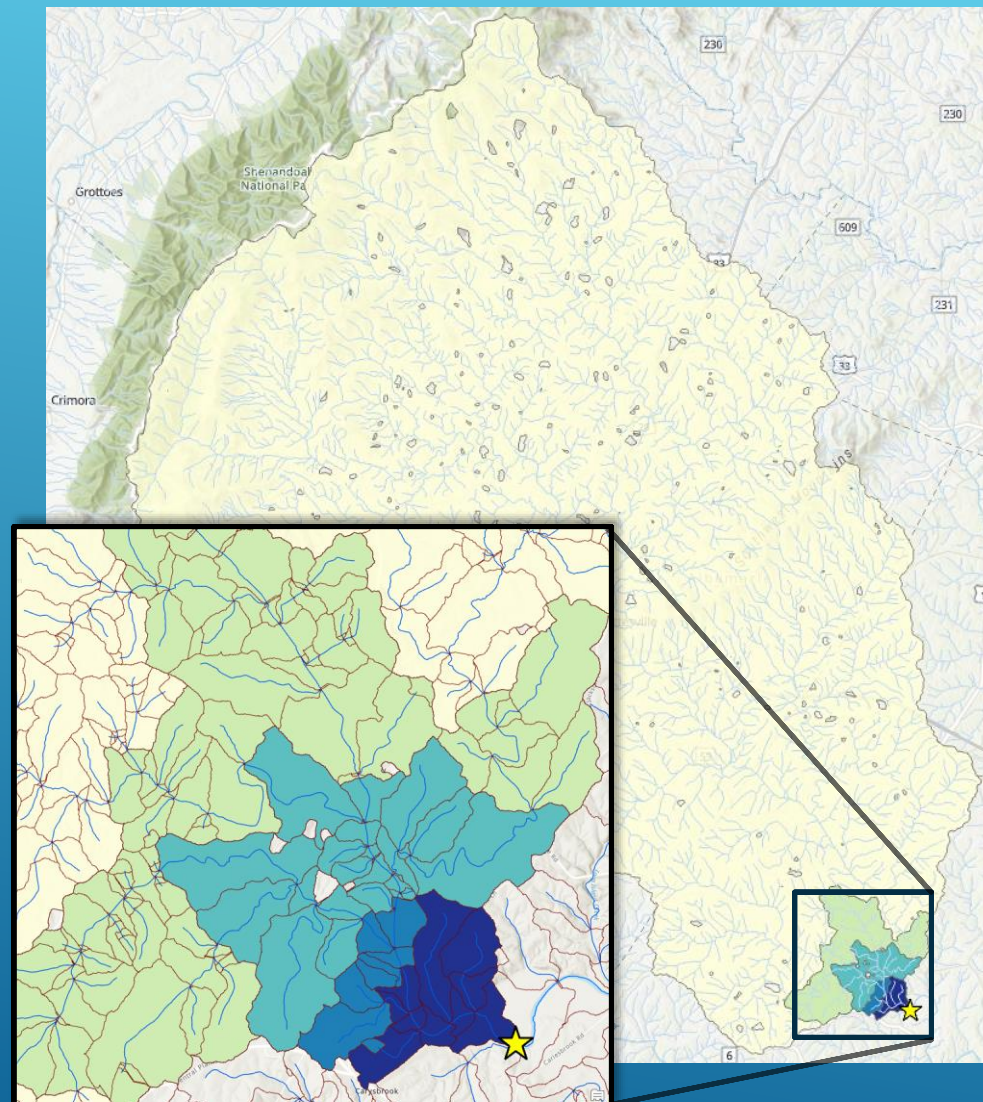
http://gis.vcu.edu/instar/

Relative Importance

For each Healthy Waters site, we delineated drainages at multiple scales:

- **Entire drainage**
- **10-km upstream**
- **5-km upstream**
- **3-km upstream**
- **2-km upstream**

Importance



Assumption:

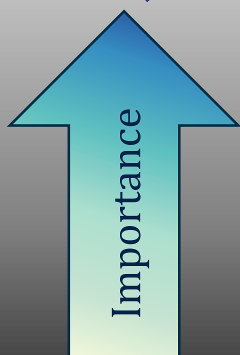
- Areas hydrologically closer to a HW site are more important than those farther away

NHDPlus-HR flowlines and catchments used for drainage delineation

Relative Importance

We counted drainage overlaps from all HW sites, and rescaled sums to importance scores.

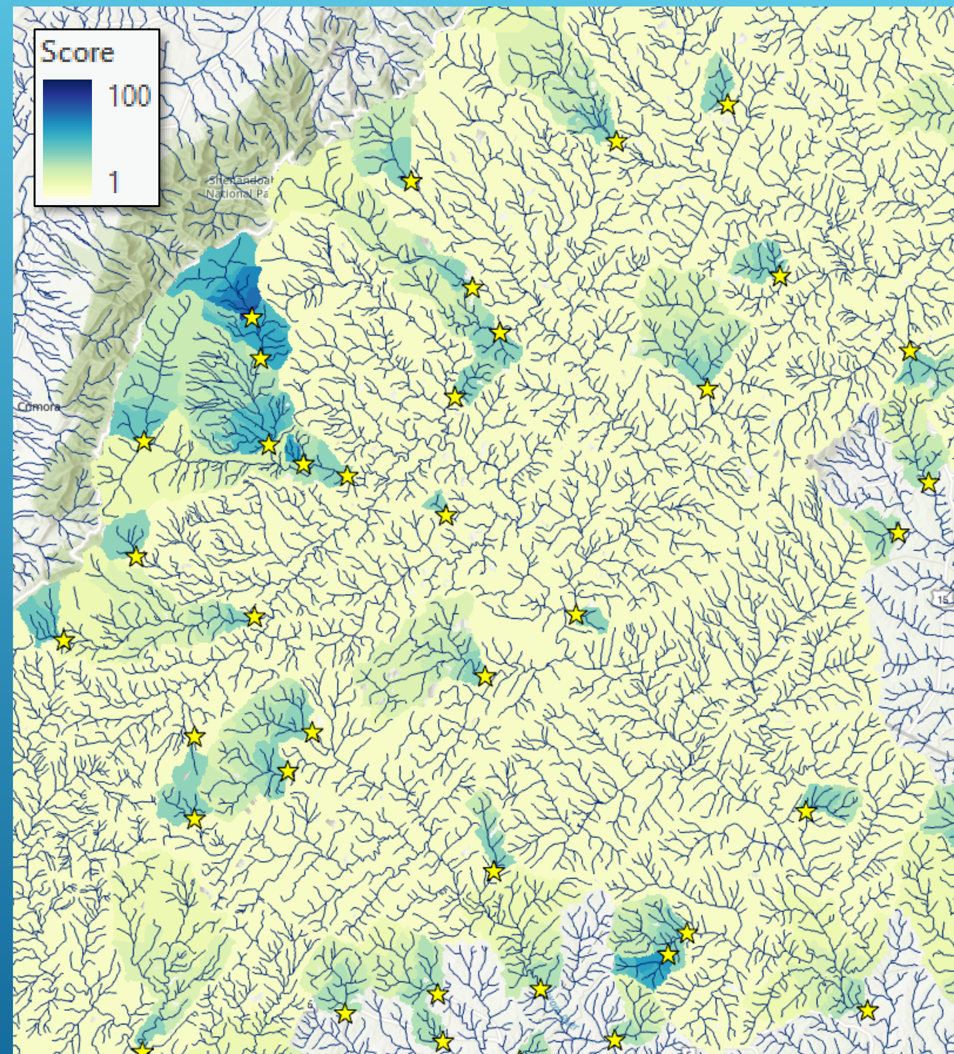
- **Multiple scales, many sites**



- **Single scale, single site**

Assumption:

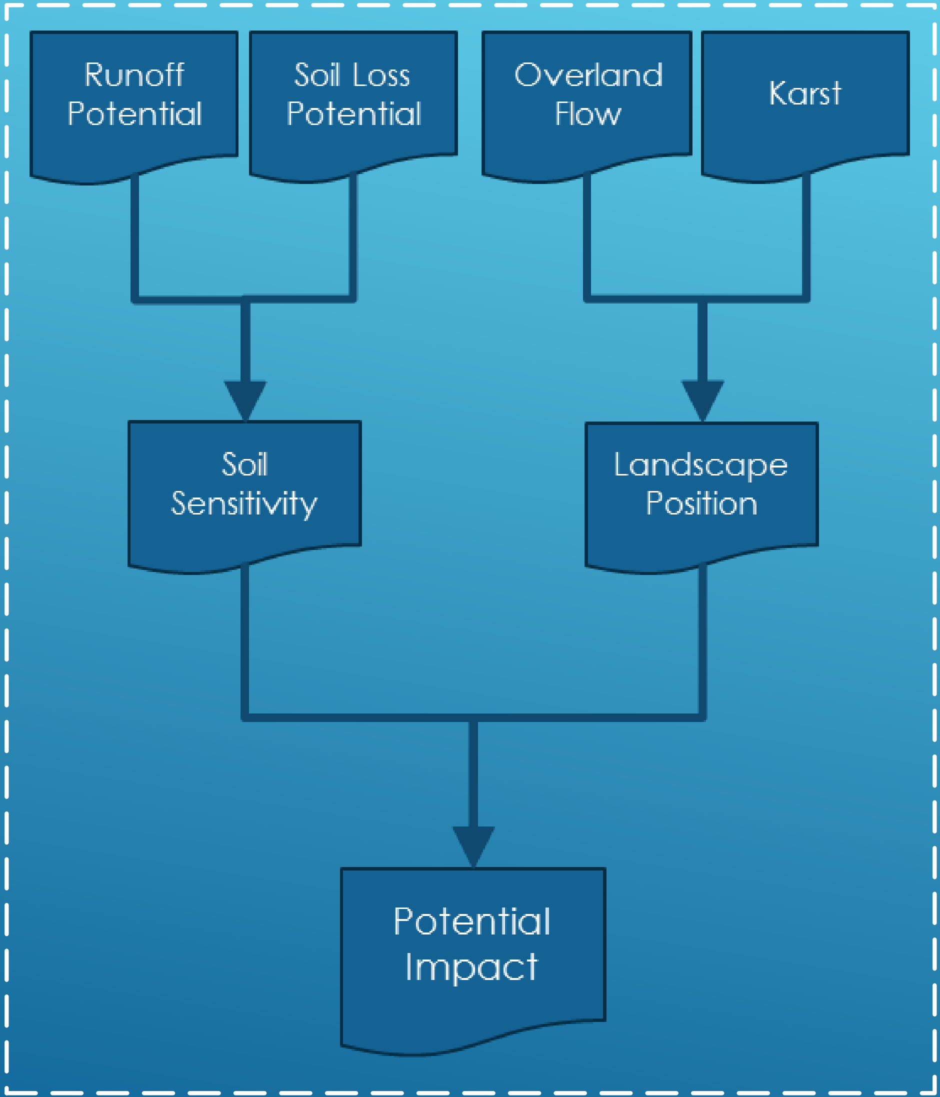
- Catchments contributing to multiple HW sites at multiple scales are more important than those contributing to a single site at a single scale



Watershed Impact Model

Potential impact depends on:

- Equations and coefficients from OpenNSPECT program
- Precipitation
- Soil type
- Slope steepness
- Overland flow to surface waters
- Prevalence of karst



Soil Sensitivity: Runoff Potential

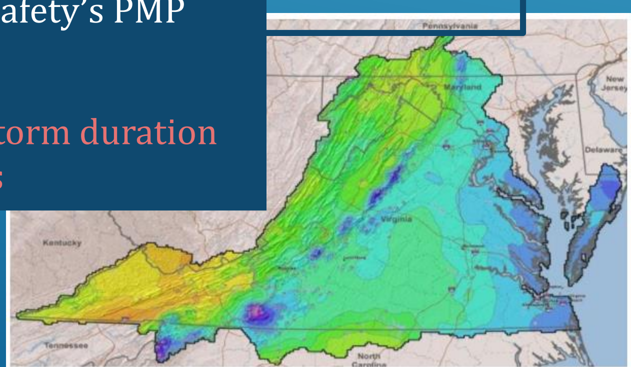
Runoff Curve Number (CN)

- Soil: Hydrologic group from gSSURGO
- Land cover: Assumed barren land

OpenNSPECT
An Open-Source Version of the
Nonpoint Source Pollution and Erosion Comparison Tool

Probable Maximum Precipitation (PMP)

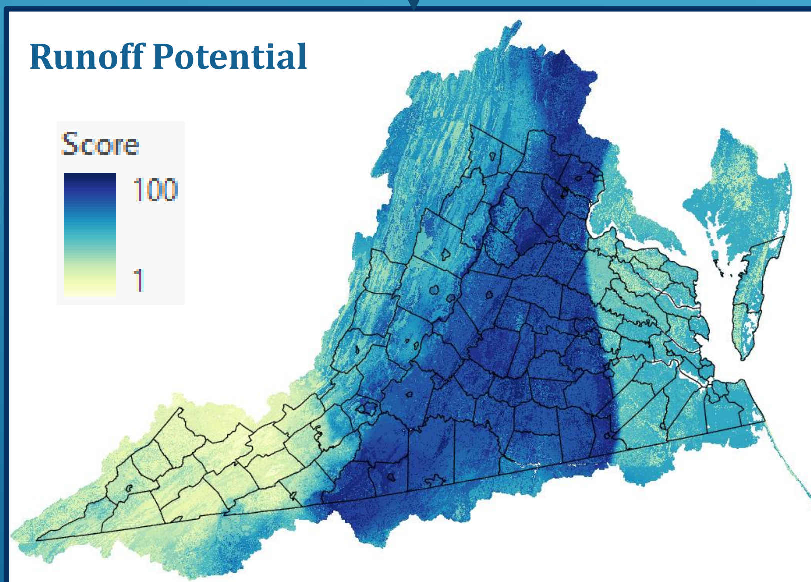
- DCR Dam Safety's PMP tool
- Assumed storm duration of 24 hours



Probable Maximum Precipitation Study for Virginia and Associated PMP Evaluation Tool and Database (November 2015)

Estimate runoff volume:
SCS Runoff Equation

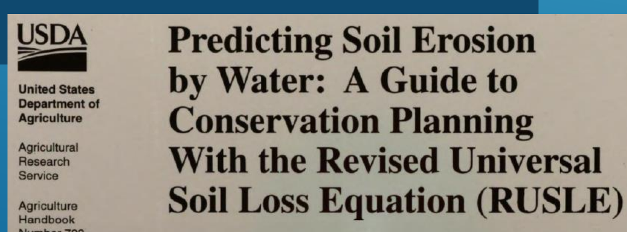
Rescale volume to score
(max volume = 100)



Soil Sensitivity: Soil Loss Potential

Revised Universal Soil Loss Equation (RUSLE) factors

- R-factor: Rainfall/erosivity (OpenNSPECT)
- K-factor: Soil erodibility (gSSURGO)
- S-factor: Slope steepness (3DEP)
- C-factor: Cover management (OpenNSPECT, assuming barren land)
- L-factor: Slope length (not included)
- P-factor: Supporting practices (not included)



USDA

United States Department of Agriculture

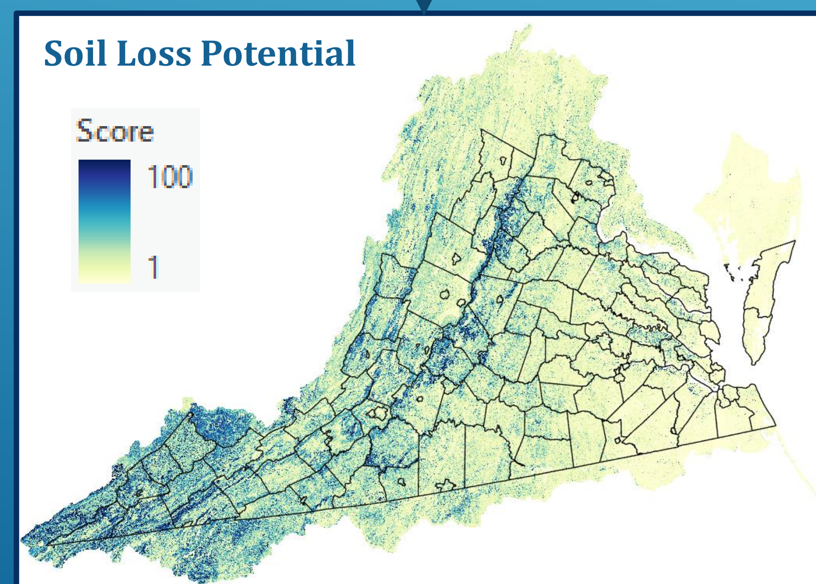
Agricultural Research Service

Agriculture Handbook Number 703

Predicting Soil Erosion by Water: A Guide to Conservation Planning With the Revised Universal Soil Loss Equation (RUSLE)

Multiply RUSLE factors (R*K*S*C)

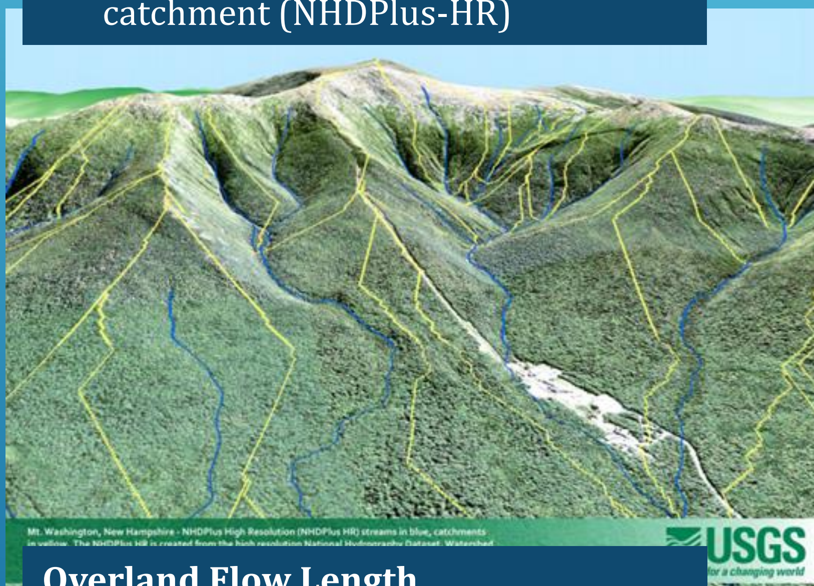
Rescale product to score (max soil loss = 100)



Landscape Position: Overland Flow

Headwaters

- Presence within a headwater catchment (NHDPlus-HR)

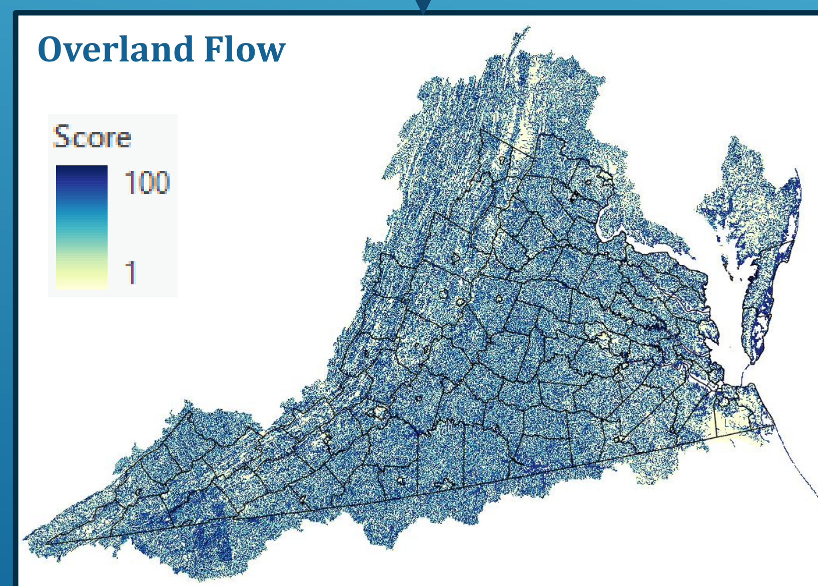


Overland Flow Length

- Distance along flow path to stream, river, or water body (NHDPlus-HR)

Rescale flow length to score (adjacent to water = 100)

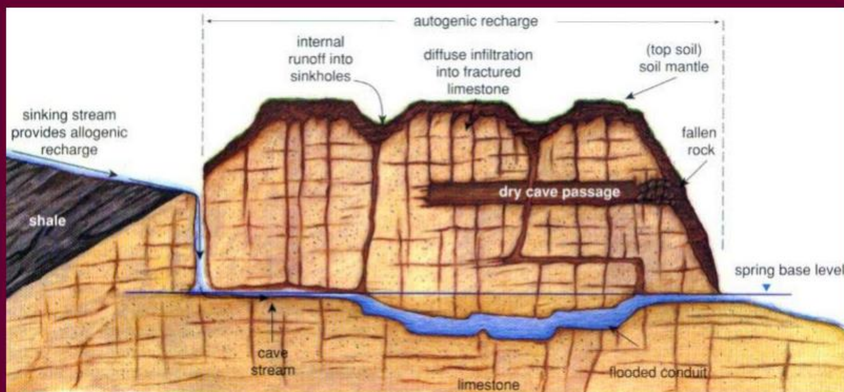
Discount score (x 90%) for areas outside of a headwater catchment



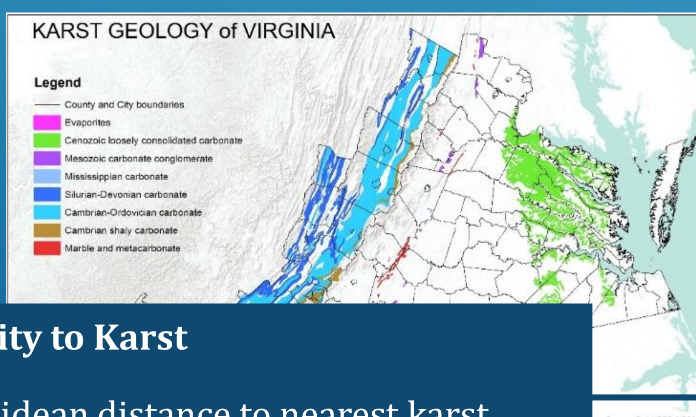
Landscape Position: Karst

Prevalence of Sinkholes

- Kernel density of sinkholes (DMME)



Cross-section diagram by David Culver, American University.



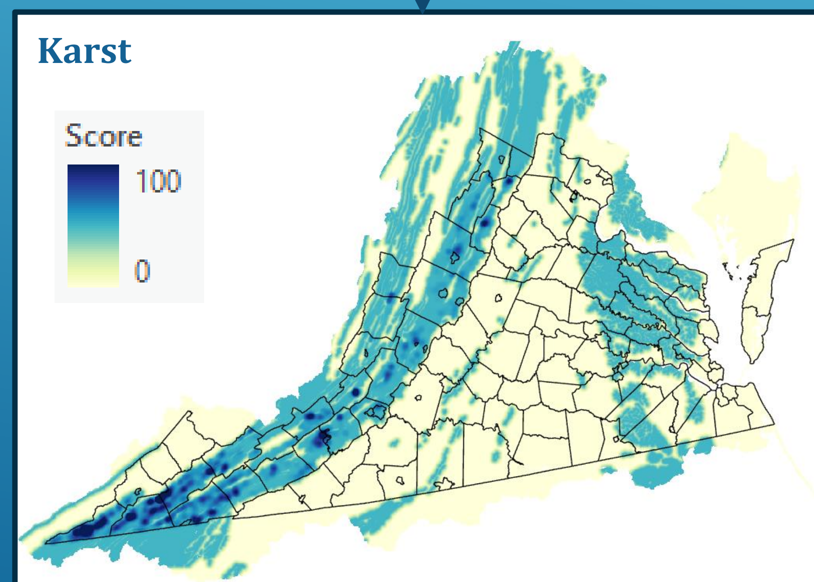
Proximity to Karst

- Euclidean distance to nearest karst geology (Weary & Doctor 2014)

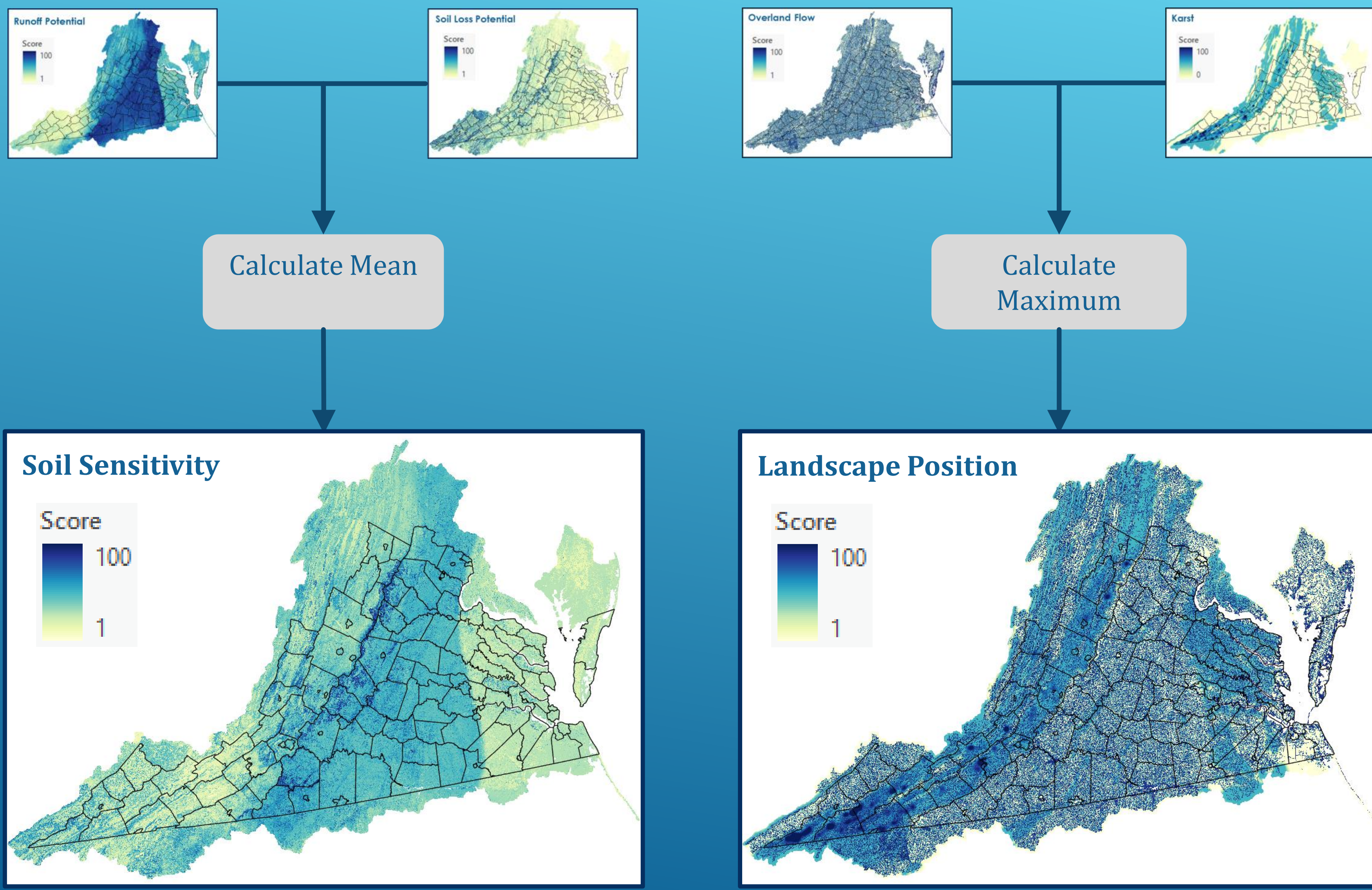
Rescale sinkhole density to score (max density = 100)

Rescale karst distance to score (adjacent to karst = 100)

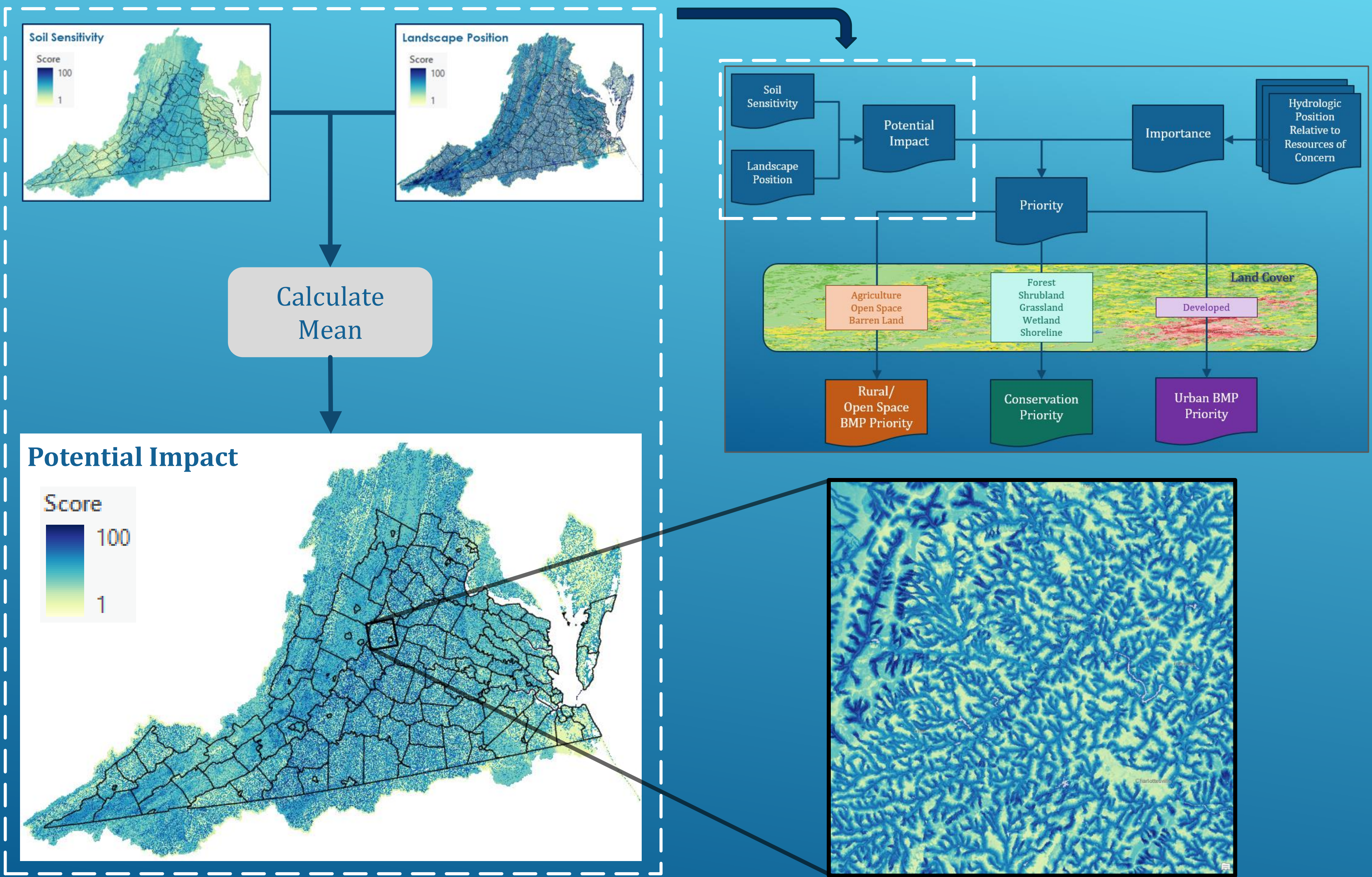
Calculate mean score



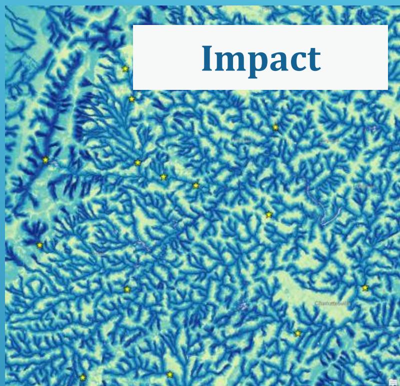
Potential Impact: Soil Sensitivity and Landscape Position



Potential Impact



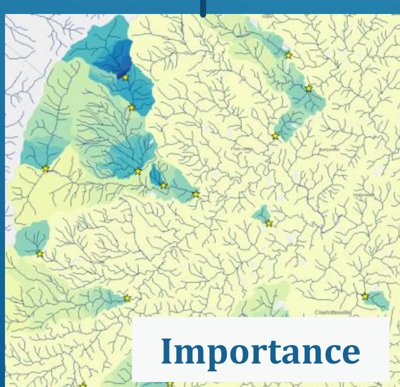
Final Prioritization



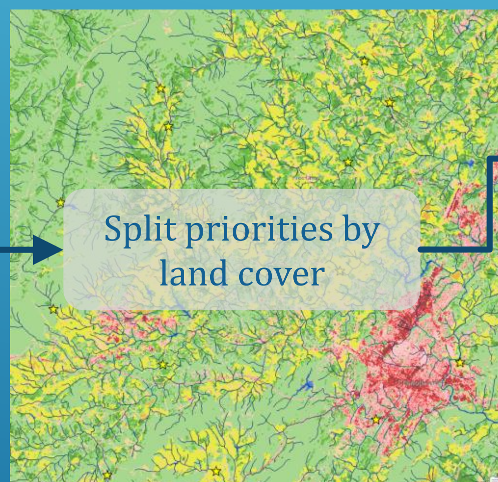
Impact

Calculate product

Slice into priority quantiles

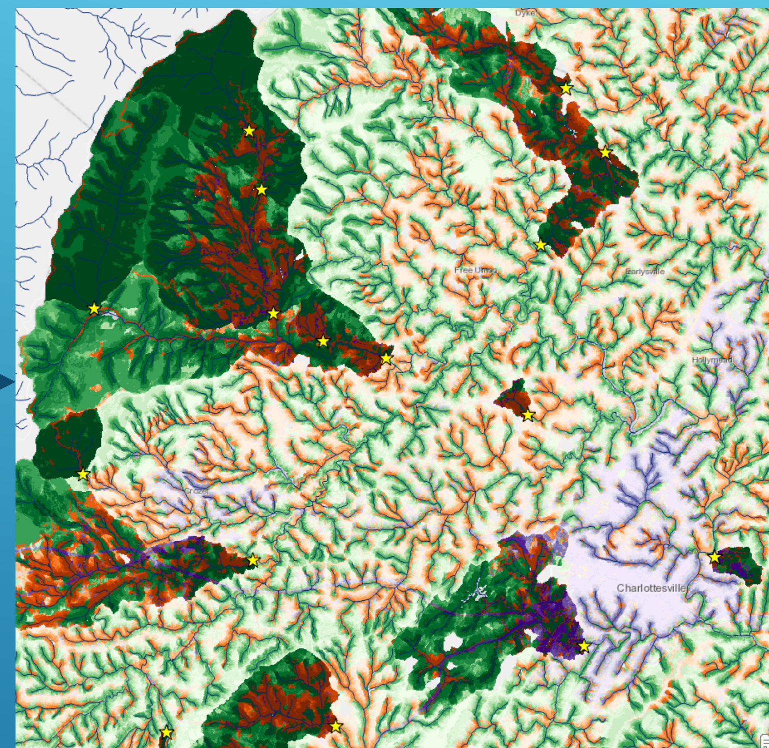


Importance



Split priorities by land cover

Final Priorities



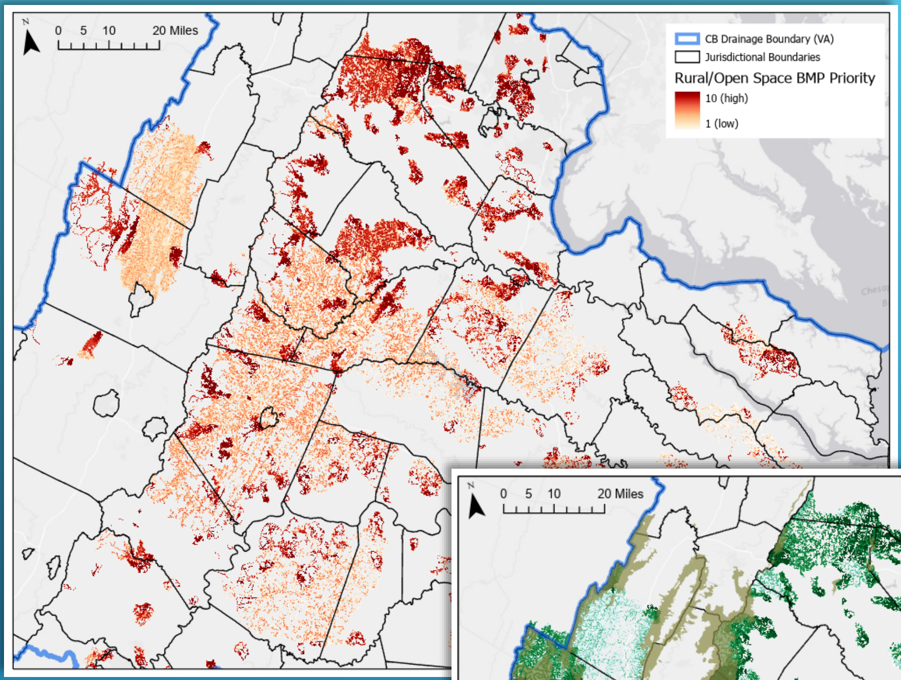
Conservation Priority

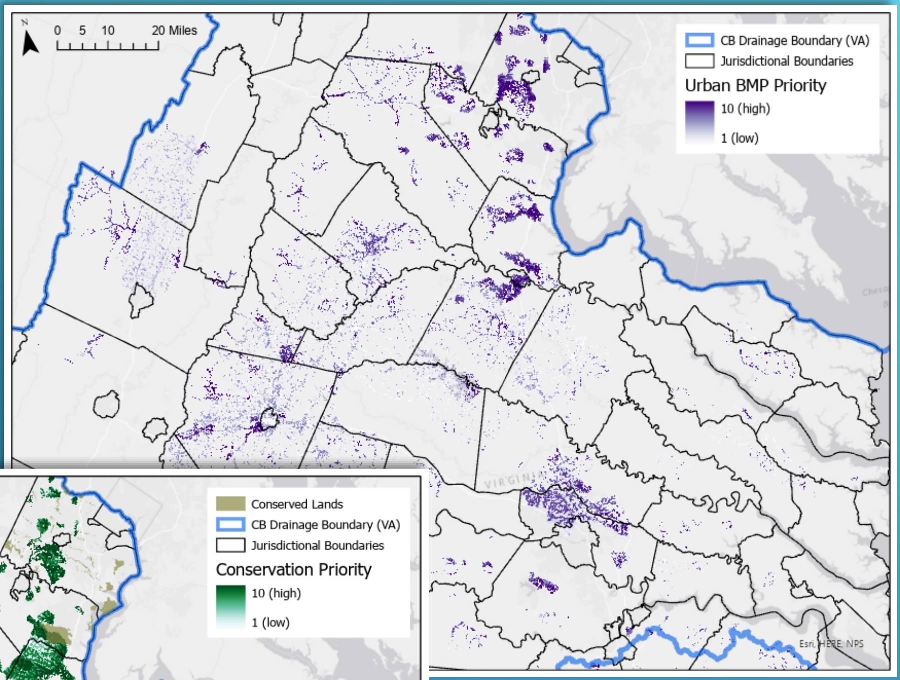
Rural/Open Space BMP Priority

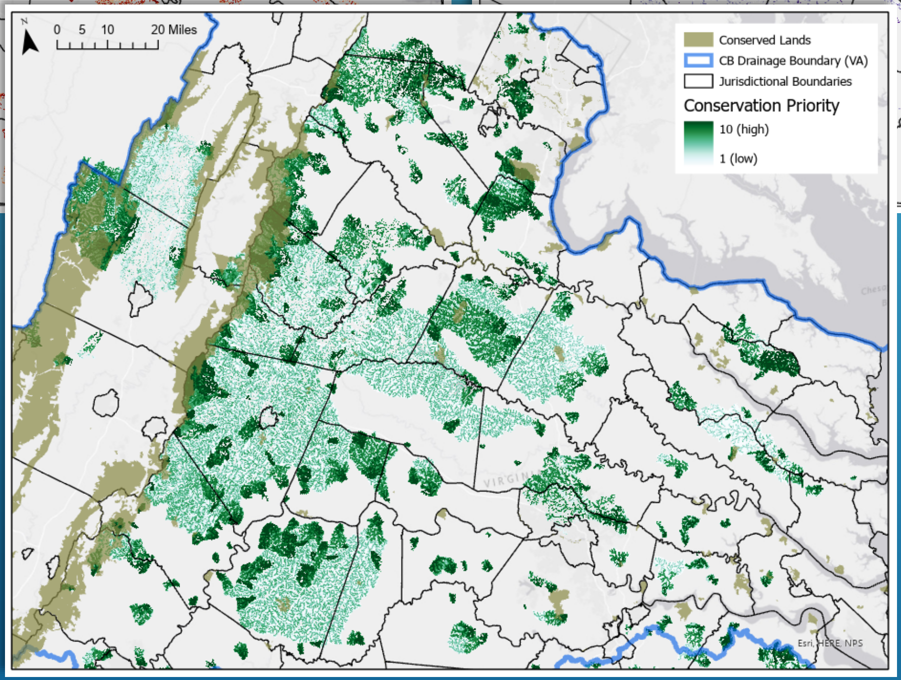
Urban BMP Priority

1 (low) — 10 (high)

Healthy Waters Prioritization Model: Three Outputs

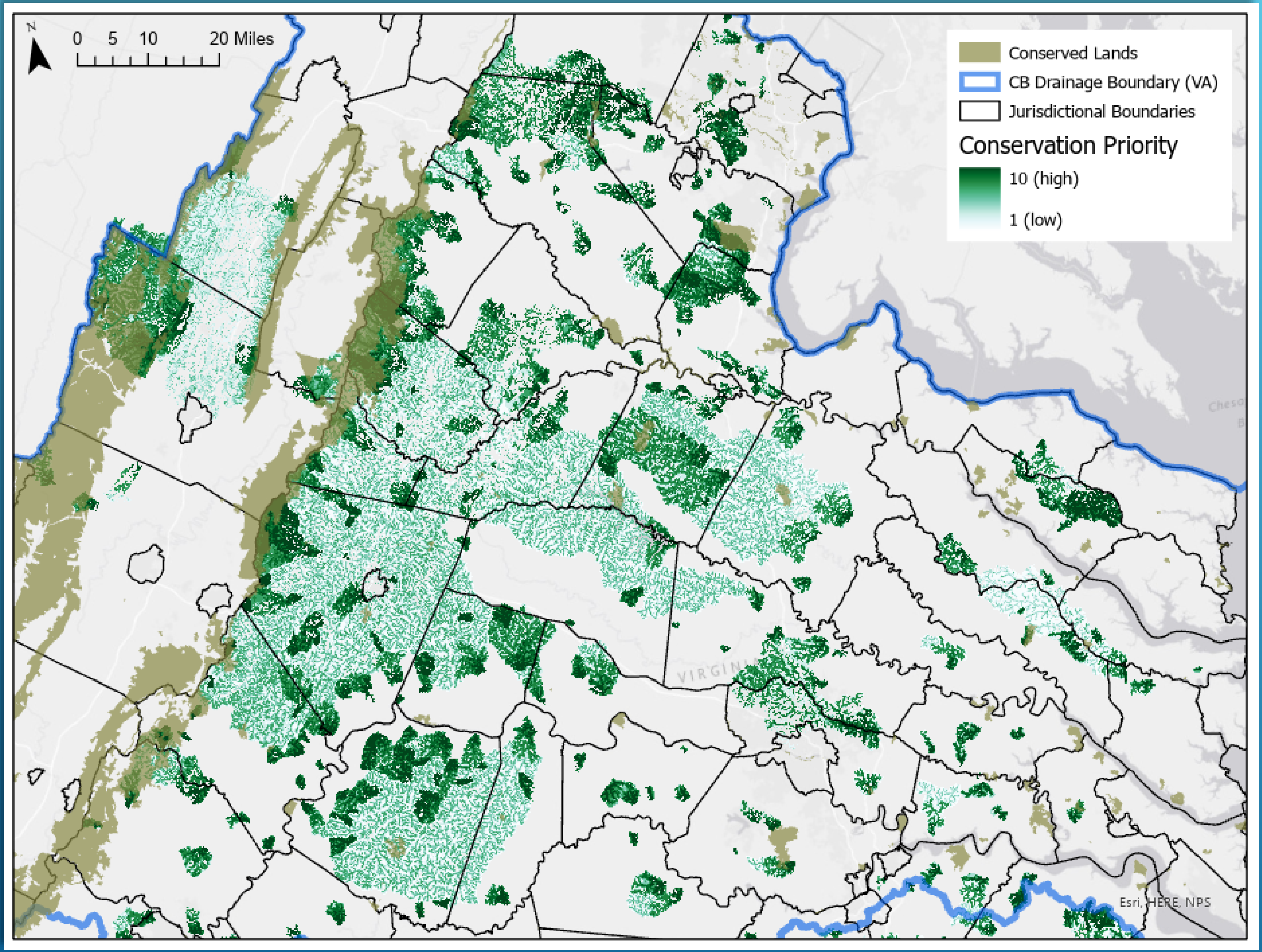




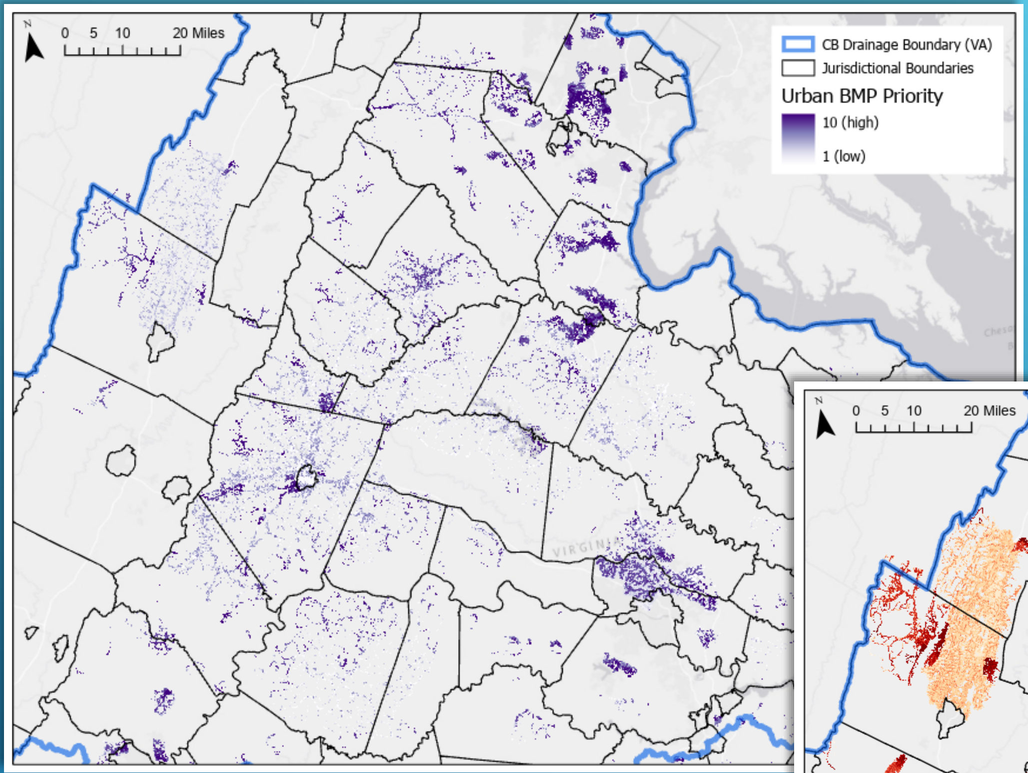


Healthy Waters Prioritization Model: Conservation

Target areas for land acquisition and conservation easements



Healthy Waters Prioritization Model: BMPs



Target areas for
Best Management Practices and
restoration of natural vegetation